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Abstract

THE TEMPERATURE DEPENDENCE OF THE NEUTRON INELASTIC SCATTERING ON HEAVY WATER

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The scattering of cold neutrons on heavy water was studied, using the filter technique for producing the cold neutron beam and the time of flight method for the analysis of scattered neutron spectra.

For the achievement of an optimal ratio of cold neutrons to thermal and epithermal ones we chose a filtration assembly formed by a beryllium policrystalline filter and a lead monocrystal.

The over-all time of flight resolution of the device of 3.5% has been obtained using a curved slit chopper in optimal transmission regime for 4 Å neutrons.

The measurements were extended over an angular range of 30° to 90°, the sample temperature varying between -100°C and +80°C.

The obtained curves have been corrected for background, chopper transmission, scattering and absorption in air and counter efficacity.

The diffusive properties of heavy water dependent on temperature have been obtained by detailed analysis of the quasielastic scattering peaks.

The results have been compared with theoretical models viz. with Vineyard's model (continuous diffusion) and Singwi-Sjölander model (jump diffusion) respectively and also with the experimental results obtained in other laboratories.

A quantum level superimposed on the quasielastic peak was also detected; it is probably due to a fine structure having the same order of magnitude as that obtained by Hughes et al. in the case of light water.

In the inelastic scattering region a succession of peaks have been observed which have been ascribed to the heavy water molecule rotation vibration levels.

As the target temperature decreases down to -100°C there occurs a significant modification of the inelastic scattering spectra.